Space Weather Technical Forecast

Issued on Sunday 30 March 2025 at 13:29 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

---

Space Weather Forecast Headline: Minor/Moderate (R1/R2) radio blackouts Expected. Active electron fluence.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity recorded at GOES16 was Moderate, with three M flares, peak was an M1.9 at 29/2300 UTC. There are six regions on the current disc. AR4048 in the southeast, is a long, large and complex spot region. A large amount of magnetic looping continues to be observed and the region has been associated with two M-class flares with associated CMEs. AR4043 spanning centre disk continues a slow decline, but is also responsible for an M-class flare and potential Earth-directed CME, though confidence is low. AR4046 remains large but unipolar. AR4047 in the southwest and AR4044 in the northeast both follow a similar developing trend, with both leading and trailing portions developing mature penumbra and spreading. The final active region is small and magnetically simple.

Solar Wind / Geomagnetic Activity: Solar wind parameters, as measured by ACE at L1, were indicative of gradual waning fast winds, those likely emanating from CH25/+. The solar wind speed fell from Elevated back to slightly Elevated, 530 to 450 km/s. The solar wind density was below average throughout. The Interplanetary Magnetic Field, Bt, was at weak levels, around 5-7 nT. The north-south component, Bz, varied between +/-5 nT. The phi angle was predominantly positive (away from the Sun) throughout. The net result of the above solar wind measures was for Quiet to Unsettled (Kp0-3) geomagnetic activity.

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) at GOES18 was at Background. High energy electron flux (greater than 2 MeV) at GEO is High, peaking at 2970pfu at 29/1625UTC. The 24-hour integrated fluence exceeded Active at 29/1500 UTC, with the observed 24-hour integrated fluence 1.28e8pfu at 29/2359UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Further M-class activity is Expected, with a slight chance of X-class activity.

Solar Wind / Geomagnetic Activity: A possible faint Earth-directed CME from 29 Mar may arrive on days 3 or 4 (01 or 02 Apr). The current CH HSS continues to wane and lose influence. Earth may connect with CH28/+ late day 2 or day 3 (31 or 01 April). Solar winds are therefore expected to fall back to slow-ambient speeds before rising to Elevated sometime between late day 2 into day 4 due to a combination of CH HSS and possible CME effects.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2025. All Rights Reserved.

Quiet to Unsettled geomagnetic activity is most likely. A chance of Active intervals and a slight chance of G1/Minor storm periods on days 3 and 4 (01/02 Apr) as Earth connects with CH28/+ and/or the CME from 29th.

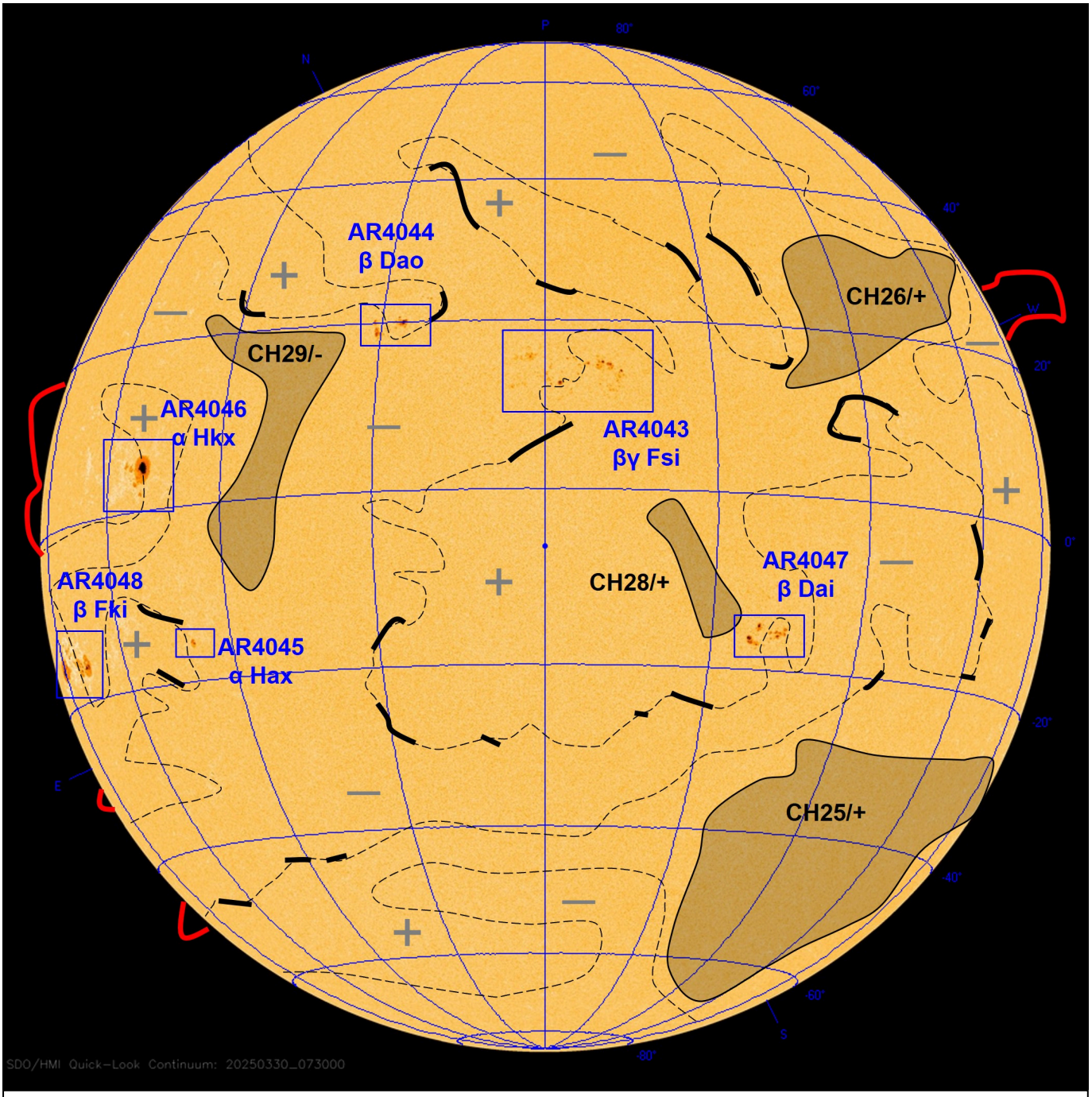
Energetic Particles / Solar Radiation: High energy proton flux is above background levels on a rising trend and therefore there is a chance of rising above today, with a slight chance thereafter should any further notable flares occur.

High energy electron flux levels are above the High threshold and the electron fluence is above the Active threshold. These perhaps remaining above for the next two to four days, with slightly reduced confidence by 01 April with possible geomagnetic activity from either a CH HSS or an Earth-directed CME.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2025. All Rights Reserved.

Figure 1: MOSWOC Solar Synoptic Map valid 30/0730UTC



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2025. All Rights Reserved.

Geomagnetic Storms

There are no definitively Earth-directed CMEs in the forecast at present. An eruption from 25 March may give a slight chance of a glance on 30 March as indicated by the latest MOSWOC Enlil ensemble forecast, although this is low confidence, and a miss is more likely. Imagery was limited for the CME related to the X1.1 flare on 28/1520 UTC, off the eastern limb in the vicinity of AR4046. The bulk of the ejecta appears to head east behind the Earths orbit, but some shock potentially could have an Earth-directed component. There is a the potential for an Earth-directed CME, from the centre disc close to AR4043, though due to lack of triangulating imagery and a very faint signature this is very low confidence, but may feature in days 3 or 4 (01 or 02 Apr).

The current CH HSS continues to wane and lose influence. There is a possible connection to CH28/+ signalled for late 31 or 01 Apr on Enlil, more probably the latter. MOSWOC Enlil output is considered to be providing a reasonably good steer on the solar wind forecast, if not perhaps overestimating the expected wind speeds from CH28/+. Solar winds are therefore expected to fall back to slow-ambient speeds before rising to Elevated sometime between late day 2 into day 4 due to a combination of CH HSS and possible CME effects.

Quiet to Unsettled geomagnetic activity is most likely. A chance of Active intervals and a slight chance of G1/Minor storm periods on days 3 and 4 (01/02 Apr) as Earth connects with CH28/+ and/or the CME from 29th.

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	5	20	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2025. All Rights Reserved.

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R⊙ (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed (km/s)	Estimated Arrival Time (UTC)	Comments
25/1741 UTC	Partial	Filament eruption	SE	1300 km/s	29/1800 UTC	Low confidence as modelled on limited availability of imagery.
30/0800 UTC	Partial	Flare	North Centre	425	02/0000UTC	Very low confidence. Lack of triangulating imagery.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2025. All Rights Reserved.

Radio Blackouts - X-Ray Flares

Solar activity was Moderate, with three M-class flares. The peak flare (which was the second which occurred) was M1.9 class flare at 29/2300 UTC. The first M-class flare was from the centre disc close to AR4043, with a chance a very faint CME in imagery may have been associated with this, which may have an Earth-directed component. The last two M-class flares were observed from the southeastern limb, near to AR4048.

There are six regions on the current disc. AR4048 in the southeast, is a long, large and complex spot region. A large amount of magnetic looping continues to be observed and the region has been associated with two M-class flares with associated CMEs. AR4043 spanning centre disk continues a slow decline, but is also responsible for an M-class flare and potential Earth-directed CME, though confidence is low. AR4046 remains large but unipolar. AR4047 in the southwest and AR4044 in the northeast both follow a similar developing trend, with both leading and trailing portions developing mature penumbra and spreading. The final active region is small and magnetically simple.

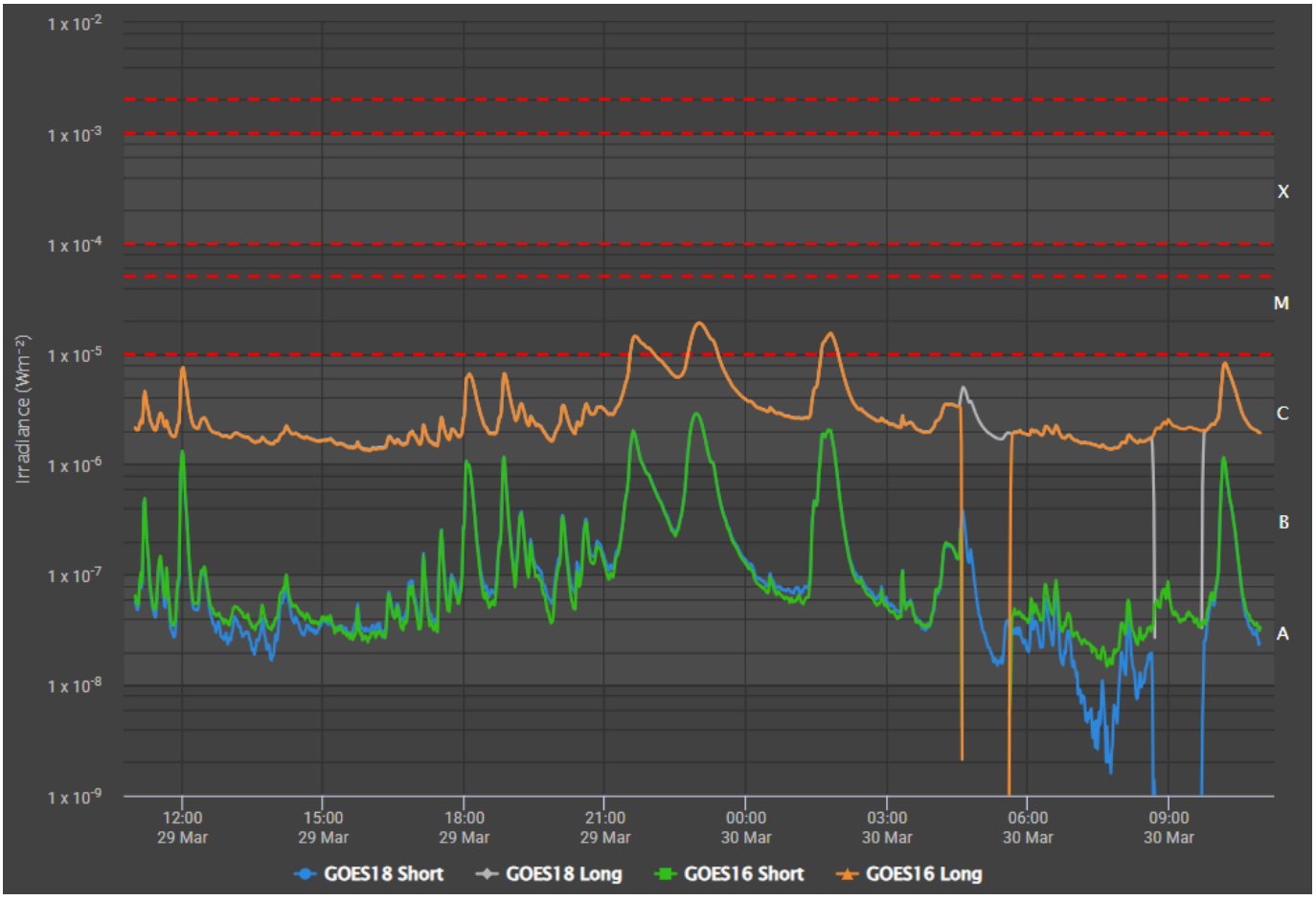
All considered, no significant regions depart in the four days, and the oncoming regions are perhaps already present, leading to a level trend. Due to some increase in complexity of active regions on the current disc, further M-class flares are expected with a slight chance of reaching X-class.

X-Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 (M Class)	Yes	80	80	80	80
Very Active	R3-R5 (X Class)	No	10	10	10	10

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2025. All Rights Reserved.

Figure 2: 24 hour X-ray flux.



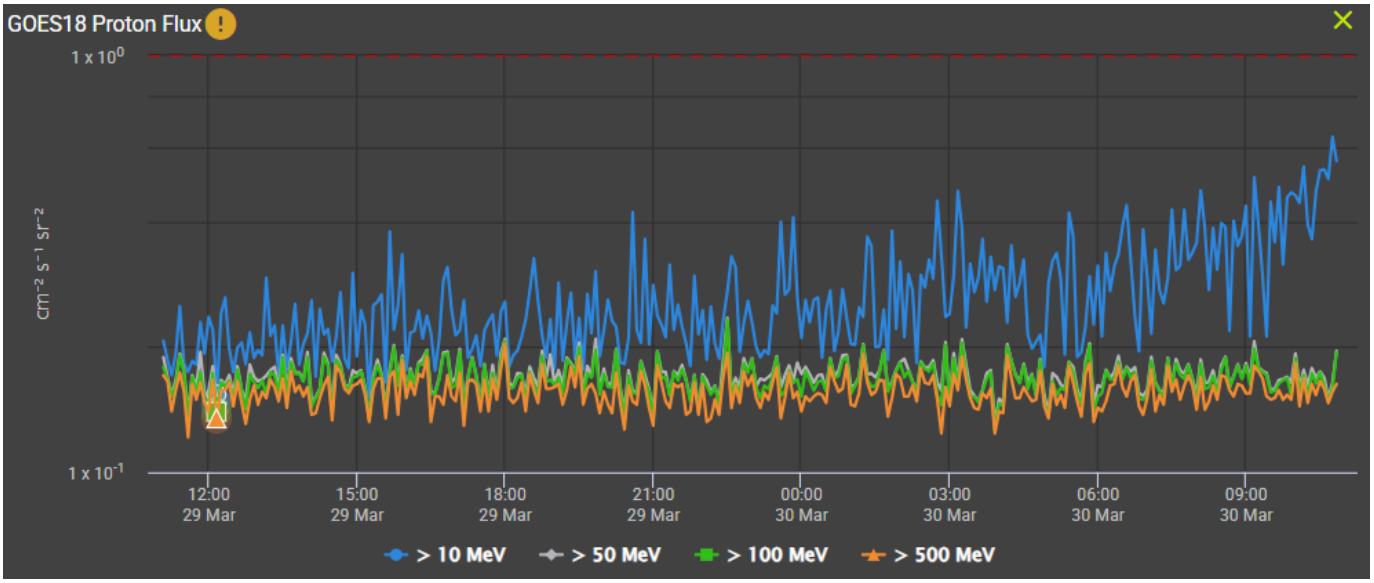
© Crown Copyright 2025. All Rights Reserved.

Solar Radiation Storms (High Energy Protons)

GOES18 high energy (>10MeV) proton flux was at or near Background levels initially, with a slight increasing trend through the first part of 30 Mar, this likely as a result of one, or a combination of the Moderate-class flares and associated CMEs leaving the Sun in the past 18 hours. The daily risk of S1 or greater starts as a chance today due to the recent enhancement, then falls to a slight chance for the remainder of the period, due to the westward advance of the far eastern active regions.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	40	20	20	20
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 3: 24 hour proton flux.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

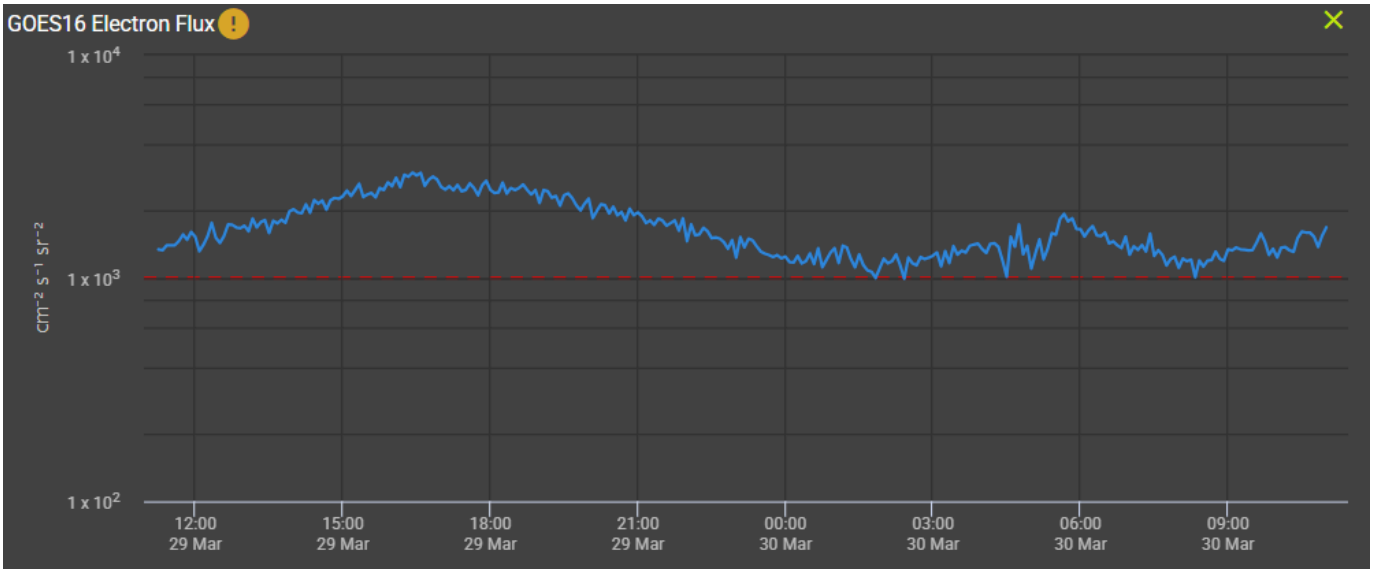
© Crown Copyright 2025. All Rights Reserved.

High Energy Electrons (≥ 2MeV)

High energy electron flux (greater than 2 MeV) have been above the High threshold for the past 24 hours and is likely to continue above the threshold initially, with a reducing trend. This, in part, due to the reduction in the HSS from CH25/+, the lack of any future significant charging events, and the possibility of a CME arrival on day 3 (01 Apr), which may serve to knock-out electron counts at GEO late in the period. Active levels of the 24-hour integrated fluence has been observed since 29/1500 UTC and are expected to remain Active through days 1 and 2 (30 and 31 Mar), before reducing confidence from late day 3 onward.

GEO Electron Environment Probability (Exceedance)	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ 1×10^{8}**	Yes	100	95	70	30
Very Active	**≥ 2 MeV ≥ 1×10^{9}**	No	1	1	1	1

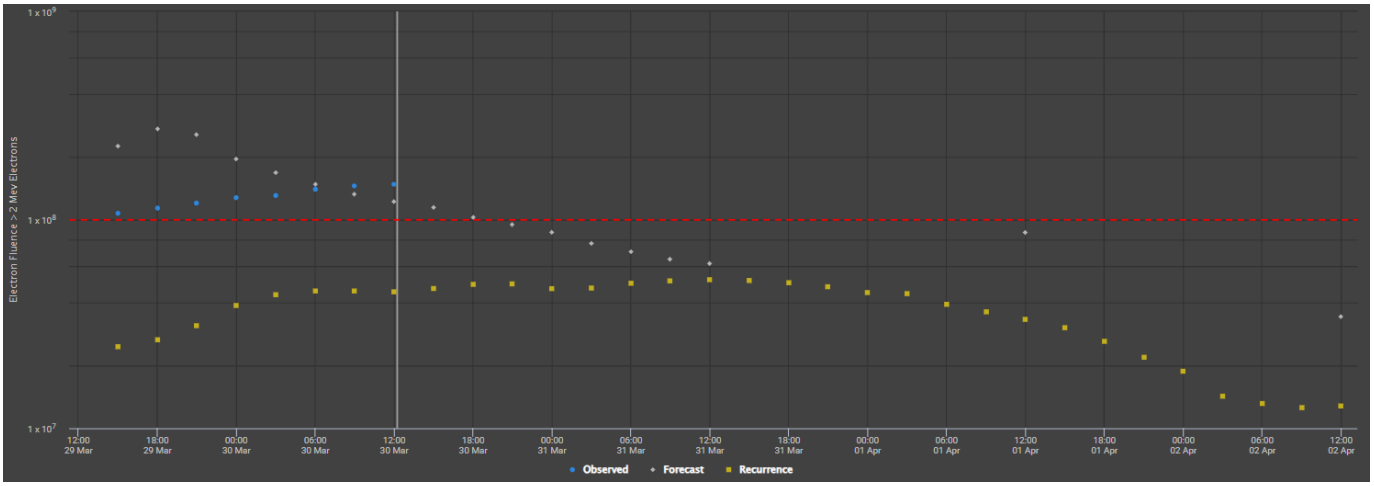
Figure 4: 24 hour electron flux



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2025. All Rights Reserved.

Figure 5: MOSWOC REFM fluence forecast/observations/recurrence.



© Crown Copyright 2025. All Rights Reserved.